



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

10/589,852

11/27/2006

Noboru Ichinose

PHKF-05004US

3677

21254 7590 10/30/2007  
MCGINN INTELLECTUAL PROPERTY LAW GROUP, PLLC  
8321 OLD COURTHOUSE ROAD  
SUITE 200  
VIENNA, VA 22182-3817

EXAMINER

WHALEN, DANIEL B

ART UNIT

PAPER NUMBER

4176

MAIL DATE

DELIVERY MODE

10/30/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

## Office Action Summary

Application No.

10/589,852

Applicant(s)

ICHINOSE ET AL.

Examiner

Daniel Whalen

Art Unit

4176

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 27 November 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-8 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-8 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 17 August 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
- 1) ☒ Certified copies of the priority documents have been received.
  - 2) ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - 3) ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date 11/21/2006.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_.

Art Unit: 4176

### DETAILED ACTION

1. This action is a first Office action on the merits of Application Serial No. 10/589,852. Currently, claims 1-8 are pending.

### *Priority*

Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

### *Information Disclosure Statement*

The references cited within the Information Disclosure Statement (IDS) submitted on 11/21/2006 have been considered by the examiner.

### *Claim Rejections - 35 USC § 102*

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. **Claim 1-8** are rejected under 35 U.S.C. 102(b) as being anticipated by Harwig et al. ("Electrical Properties of  $\beta$ -Ga<sub>2</sub>O<sub>3</sub> Single Crystals. II," Journal of Solid State Chemistry Vol. 23, pages 205-211, 15 January 1978; hereinafter "Harwing").

Art Unit: 4176

4. **Regarding Claim 1**, Harwig teaches a method of controlling a conductivity of a  $\text{Ga}_2\text{O}_3$  system single crystal, characterized in that:

a desired resistivity is obtained by adding a predetermined dopant to the  $\text{Ga}_2\text{O}_3$  system single crystal (page 205, introduction line 1-15, experimental line 1-13).

**Regarding Claim 2-3**, Harwig teaches that the predetermined dopant is a group IV element (Zr; also applies to **claim 3**), which decreases a resistance of the  $\text{Ga}_2\text{O}_3$  system single crystal (page 205, introduction line 1-15; experimental line 1-13).

Applicant should note that conductivity is simply the reciprocal of its resistivity.

**Regarding Claim 4**, Harwig teaches that a value of  $2.0 \times 10^{-3}$  to  $8.0 \times 10^2 \Omega\text{cm}$  is obtained as the desired resistivity by adding a predetermined amount of group IV element (see fig. 1 on page 206, 1000ppm Zr; page 206, result section).

**Regarding Claim 5**, Harwig teaches that a carrier concentration of the  $\text{Ga}_2\text{O}_3$  system single crystal is controlled to fall within a range of  $5.5 \times 10^{15}$  to  $2.0 \times 10^{19} \Omega\text{cm}$  as a range of the desired resistivity (page 209, right col., line 17-22).

5. **Regarding Claim 6-7**, Harwig teaches that the predetermined dopant is a group II element (Mg; also applies to **claim 7**), which increases a resistance of the  $\text{Ga}_2\text{O}_3$  system single crystal (page 205, introduction line 1-15; experimental line 1-13).

Applicant should note that conductivity is simply the reciprocal of its resistivity.

**Regarding Claim 8**, Harwig teaches that  $1 \times 10^3 \Omega\text{cm}$  or more is obtained as the desired resistivity by adding a predetermined amount of group II element (see fig. 1 on page 206, 1000ppm Mg; page 207, result section).

### ***Double Patenting***

6. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

7. **Claim 1** is provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 48 of copending Application No. 10/546,484. Although the conflicting claims are not identical, they are not patentably distinct from each other because the subject matter as claimed in the pending application in the instant office action are obvious variants of the noted claims of copending Application No. 10/546,484.

<b>Claim 1 of the instant application</b>	<b>Claim 48 of copending Application No. 10/546,484</b>
---	---

Art Unit: 4176

A method of <u>controlling a conductivity of a Ga<sub>2</sub>O<sub>3</sub> system single crystal</u> , characterized in that:	A method for manufacturing a light-emitting device characterized by: forming a substrate made of <u>a Ga<sub>2</sub>O<sub>3</sub> single crystal</u> and exhibiting <u>n-type conductivity</u> ; Adding an <u>n-type dopant</u> onto the <u>insulation substrate</u> to form a thin film exhibiting n-type conductivity;
A desired resistivity is obtained by <u>adding a predetermined dopant to the Ga<sub>2</sub>O<sub>3</sub> system single crystal</u> .	Adding an <u>n-type dopant</u> onto the <u>insulation substrate</u> to form a thin film exhibiting n-type conductivity;

Applicant should note that resistivity is simply the reciprocal of its conductivity.

Therefore, once the resistivity is obtained, then the conductivity is also obtained.

Applicant should also note that varying the dopant concentration controls resistivity and conductivity. Therefore based on claim 1 of the instant application, particularly reciting, "adding a predetermined dopant to the Ga<sub>2</sub>O<sub>3</sub> system single crystal," is understood by one of the ordinary skill in the art that controlling a conductivity of a Ga<sub>2</sub>O<sub>3</sub> is performed by adding/controlling the amount of dopant to Ga<sub>2</sub>O<sub>3</sub> to obtain a desired resistivity. In similar way, although it is not explicitly say "controlling," claim 48 of the copending application discloses, particularly reciting, "adding an n-type dopant on the insulation substrate to form a thin film exhibiting n-type conductivity" is understood by one of the ordinary skill in the art that the amount of n-type dopant added onto the insulation substrate, which is Ga<sub>2</sub>O<sub>3</sub> single crystal, controls the conductivity by obtaining its resistivity.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

8. **Claims 2-8** are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 48 of copending Application No. 10/546,484 in view of Harwig.

Claim 48 of copending Application No. 10/546,484 teaches every limitation of **Claim 1** of the instant application as it was discussed above. However, Application No. 10/546,484 does not further disclose followings, which are disclosed by Harwig:

- Copending applications lacks disclosing that the predetermined dopant is a group IV element, which decreases a resistance of the  $\text{Ga}_2\text{O}_3$  system single crystal. Harwig discloses that the predetermined dopant is a group IV element (Zr), which decreases a resistance of the  $\text{Ga}_2\text{O}_3$  system single crystal (page 205, introduction line 1-15; experimental line 1-13).
- Copending applications lacks disclosing a resistivity value of  $2.0 \times 10^{-3}$  to  $8.0 \times 10^2 \Omega\text{cm}$  by adding a predetermined amount of group IV element. Harwig discloses that a value of  $2.0 \times 10^{-3}$  to  $8.0 \times 10^2 \Omega\text{cm}$  is obtained as the desired resistivity by adding a predetermined amount of group IV element (see fig. 1 on page 206, 1000ppm Zr; page 206, result section).
- Copending applications lacks disclosing a carrier concentration of the  $\text{Ga}_2\text{O}_3$  system single crystal is controlled to fall within a range of  $5.5 \times 10^{15}$  to  $2.0 \times 10^{19} \Omega\text{cm}$ . Harwig discloses that a carrier concentration of the  $\text{Ga}_2\text{O}_3$  system single crystal is controlled to fall within a range of  $5.5 \times 10^{15}$  to  $2.0 \times 10^{19} \Omega\text{cm}$  as a range of the desired resistivity (page 209, right col., line 17-22).

Art Unit: 4176

- Copending applications lacks disclosing the predetermined dopant is a group II element, which increases a resistance of the  $\text{Ga}_2\text{O}_3$  system single crystal.  
Harwig discloses that the predetermined dopant is a group II element (Mg), which increases a resistance of the  $\text{Ga}_2\text{O}_3$  system single crystal (page 205, introduction line 1-15; experimental line 1-13).
- Copending applications lacks disclosing a resistivity value of  $1 \times 10^3 \Omega\text{cm}$  or more by adding a predetermined amount of group II element. Harwig discloses  $1 \times 10^3 \Omega\text{cm}$  or more is obtained as the desired resistivity by adding a predetermined amount of group II element (see fig. 1 on page 206, 1000ppm Mg; page 207, result section).

Therefore, it would have been obvious to one of the ordinary skill in the art at the time of the invention to integrate the method of copending Application No. 10/546,484 with further detailed information discussed above by Harwig so as to observe and control the electrical conductivity of  $\text{Ga}_2\text{O}_3$  single crystal at varying temperature.

This is a provisional obviousness-type double patenting rejection.

### ***Conclusion***

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.



Ueda et al. "Synthesis and control of conductivity of ultraviolet transmitting  $\beta$ -Ga<sub>2</sub>O<sub>3</sub> single crystals," Applied Physics Letters, 30 June 1997, Vol. 70, Issue 26, page 3561 to 3563.

Ichinose et al. (US Pub 2004/0007708 A1).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daniel Whalen whose telephone number is 517-270-3418. The examiner can normally be reached on Monday-Friday, 7:30am to 5:00pm, EST.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kimberly Nguyen can be reached on (571) 272-2402. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Art Unit: 4176

A handwritten signature consisting of the letters 'DW' in a stylized, cursive script.

Daniel Whalen

A handwritten signature in cursive script that reads 'Kiesha L. Rose'.

Kiesha L. Rose  
Primary Examiner

23 Oct. 2007